Bank of Canada Workshop on Derivatives Markets in Canada and Beyond

Toni Gravelle, Financial Markets Department

- *The development of derivatives markets supports both the efficiency and stability of the financial system.*
- *Because derivatives are designed to transfer risk rather than to transfer funds, the regulatory framework for derivatives can differ from that of stocks.*
- *Investors may not fully appreciate the risk involved in trading credit derivatives.*
- *The increasing reliance on the trading of risk-transfer instruments makes the financial system increasingly vulnerable to the possible evaporation of market liquidity.*

In September 2006, the Bank of Canada hosted a one-and-a-half-day workshop, *Derivatives Markets in Canada and Beyond*. The workshop focused on the prodigious and seemingly boundless growth in the volume and types of these risk-transfer instruments. It was also a forum where participants could exchange views on key developments in derivatives markets, voice concerns related to the risks associated with derivatives, and discuss areas where Canadian derivatives markets have led or lagged behind those in global financial centres. The event brought together market participants, regulators, policy-makers, and academics from various countries. This article presents the highlights of the workshop.

Background: Derivatives Basics

A financial derivative is an instrument whose payoff is typically linked to the underlying prices or value of interest rates or exchange rates, equity indexes, or other financial securities. More generally, the underlying price or payoff can be linked to almost anything, from the price of gasoline or wheat to the summer temperature readings in a particular city, or even the release of macroeconomic data, such as the size of the gross domestic product (GDP) or employment growth registered for the preceding quarter or month. Derivatives typically fall into one of the following categories: futures or forwards on equity, interest rates, and currency instruments; interest rate and currency swaps; options on equity, currency, interest rates, futures, and swaps; and interest rate caps, floors, and collars. As well, derivatives that are linked to the likelihood of default of one or several debt instruments have recently emerged and are one of the fastest-growing segments of this market.

The derivatives that trade on organized exchanges are futures and exchange-traded options. These derivatives consist of standardized contracts because exchanges are better suited to the trading of less complex and more "commoditized" financial instruments. A much broader and faster-growing range of derivatives instruments, including relatively more complex ones, are traded in the over-the-counter (OTC) markets by financial institutions, fund managers (including pension and hedge fund managers), and corporate treasurers. This segment of the derivatives market is also where innovation seems to flourish the most, with new, and at times complex, "made-to-order" derivatives contracts appearing regularly. Perhaps the most significant development in financial markets over the past five years or so has been the rapid development of credit derivatives. Discussions in several of the sessions focused or touched upon the evolution of credit derivatives.

In what follows, we provide a thematic synopsis of the various topics discussed during the workshop sessions.

Globalization and Technological Advances

There are two key drivers of innovation and growth in derivatives markets. The first is the globalization of finance, which has accompanied, and in many ways has been made possible by, the modernization and globalization of commercial and investment banking. The prodigious growth and development of derivatives markets are both symptoms and drivers of the globalization of finance. Specifically, derivatives markets have developed in parallel with the emergence of globally active financial intermediaries that handle the bulk of the international capital and capital flows in the major financial market centres, such as New York and London.

The prodigious growth and development of derivatives markets are both symptoms and drivers of the globalization of finance.

Although the trend to use globally active financial intermediaries has been evident in the banking industry since the 1980s and 1990s, several workshop participants noted the recent development of this trend within the pension fund sector in Canada. The sector has embraced active portfolio management, which largely entails the vigorous use of derivatives.[1] Moreover, Canadian fund managers have increasingly taken a global view of asset diversification and risk management, and larger Canadian funds have increasingly sought to create synthetic exposures to asset classes not readily available in Canada.[2] In doing so, they are more often seeking out larger foreign dealers to handle a growing share of their trading activity in derivatives markets.

These larger financial intermediaries tend to develop innovative derivatives structures in order to meet their own and their clients' needs and are better placed to take advantage of the economies of scale required to trade derivatives on a global basis. Workshop participants noted that an intrinsic characteristic of derivatives instruments is that they are designed to transfer risk, whereas stocks or bonds are designed to be an explicit claim on the stream of cash flows generated from the ownership of a financial asset in a certain jurisdiction. This characteristic also makes them more amenable to borderless trading, making OTC derivatives markets, in particular, more global in nature than, say, largely nationalistic equity markets.

The second driver is the rate of development of financial innovations and new derivatives instruments, which has been sustained by the continued advances in, and falling costs of, computing power and telecommunications.[3] Advances in information technology, coupled with financial institutions' drive to enhance returns and expand their global reach, have contributed to an environment in which financial intermediaries (and, to some extent, their clients, particularly hedge funds) are continuously introducing and / or embracing new derivatives instruments and advances in risk-management techniques. This in turn reinforces the increasing dependence of derivatives markets on technological advances for their development. Although there have

1. In addition, it was noted that several of the larger Canadian pension funds had become active in the New York and London credit derivatives markets.

2. For example, given the heavy weighting of the Toronto Stock Exchange index towards resource and financial-based stocks, Canadian pension fund managers have sought to increase their exposure to other corporate sectors via equity portfolio allocations in foreign jurisdictions, often using derivatives to take on the exposure or at least to hedge part of the foreign exchange exposure assumed when purchasing foreign stocks.

3. One workshop participant noted that the exponential growth in the volume of exchange-traded equity options traded in the United States was the result of two factors: increased competition resulting from technological innovations and electronic trading platforms, and regulatory changes aimed directly at inciting more competition across exchanges, such as allowing the cross-listing of equity options.

been numerous innovations in derivatives markets over recent years, none has been as important as the technological advances that have permitted the separation and active trading of credit risk. This is discussed in more detail below.

The Potential Benefits of the Growth of Derivatives

The first few sessions of the workshop described the trends in the growth of both OTC and exchange-traded derivatives in Canada and worldwide, with several participants noting that the evolution of derivatives markets has accelerated rapidly over the years, creating several potential benefits. A broader array of derivatives increases the ability of market participants to unbundle and separately trade the various risk components embodied in financial instruments.[4] This in turn allows market participants who trade derivatives to manage their financial risks more easily. The trading and transfer of risk also allows for the wider dispersion of risks across the financial system and increases cross-border capital flows. These factors have likely been key elements underpinning the greater resilience of financial institutions to market stresses over the years and have enabled markets to more effectively allocate capital to its highest return. Overall, developments in the derivatives market have contributed to more complete financial markets, and have improved market liquidity and increased the capacity of the financial system to effectively price and bear risk. The economy benefits as well, since broad, deep, and well-functioning capital markets contribute to a more efficient financial system, one which leads to stronger economic growth over time.

Developments in the derivatives market have contributed to more complete financial markets, and have improved market liquidity and increased the capacity of the financial system to effectively price and bear risk.

Perhaps the clearest evidence of the private benefits of derivatives is the continued spectacular growth of derivatives markets. As a result of the increasing demand for these products, the size of the OTC derivatives market reached a notional principal value of US$415 trillion by the end of 2006 (Bank for International Settlements 2007). Indeed, from 2005 to 2006, OTC derivatives markets grew by roughly 40 per cent, higher than the average annual growth rate for the previous four years (Chart 1).[5] At the same time, the size of the global exchange-traded derivatives market reached US$26 trillion in notional value by the end of 2006 (BIS 2007) (Chart 2). Turnover is similarly large. The most recent BIS data on OTC instruments and exchange-traded derivatives indicate that turnover rose from US$1.8 trillion in 2001 to roughly US$6.5 trillion per day in 2004, which converts to US$1,700 trillion on an annual basis. By comparison, nominal global GDP stood at US$51.5 trillion in 2006.

The sharp rise in OTC derivatives activity largely reflects the rapid growth of interest rate swaps and credit-default swaps. Workshop participants noted a similar trend in Canada. The Canadian interest rate swap (IRS) market has experienced exponential growth in volumes over the past five years (anecdotal evidence indicates growth of 25–50 per cent per year), accompanied by a significant narrowing of IRS bid / ask spreads. This growth has been driven mainly by the broadening of the Canadian IRS investor base to include foreign financial institutions and hedge fund as they seek to hedge their exposures to, or speculate on, cross-country differences in expected interest rate movements. The observed globalization of the investor base is also an important factor explaining the sharp rise in activity for Canadian exchange-traded financial derivatives. Between 2004 and 2006, the average daily volume of financial derivatives[6] contracts at the Montréal Exchange climbed by over 125 per cent. During this period, the proportion of foreign participants at the Montréal Exchange rose from approximately 40 per cent to close to 60 per cent.

4. It allows gasoline producers, for example, to separately measure and trade the price risk they face in selling gasoline from the risk they face in buying oil to produce the gasoline.

5. Note that the notional amounts overstate the risk embodied in the derivatives. The gross market value of derivatives, which measures the cost of replacing all existing contracts, represents a better measure of risk at any point in time. The gross amount at the end of 2006 was US$10 trillion, roughly the same amount as in 2005.

6. In discussing financial derivatives, we are explicitly excluding commodity futures contracts.

Chart 1

Volume of OTC Derivatives

Notional amount, US$ trillions

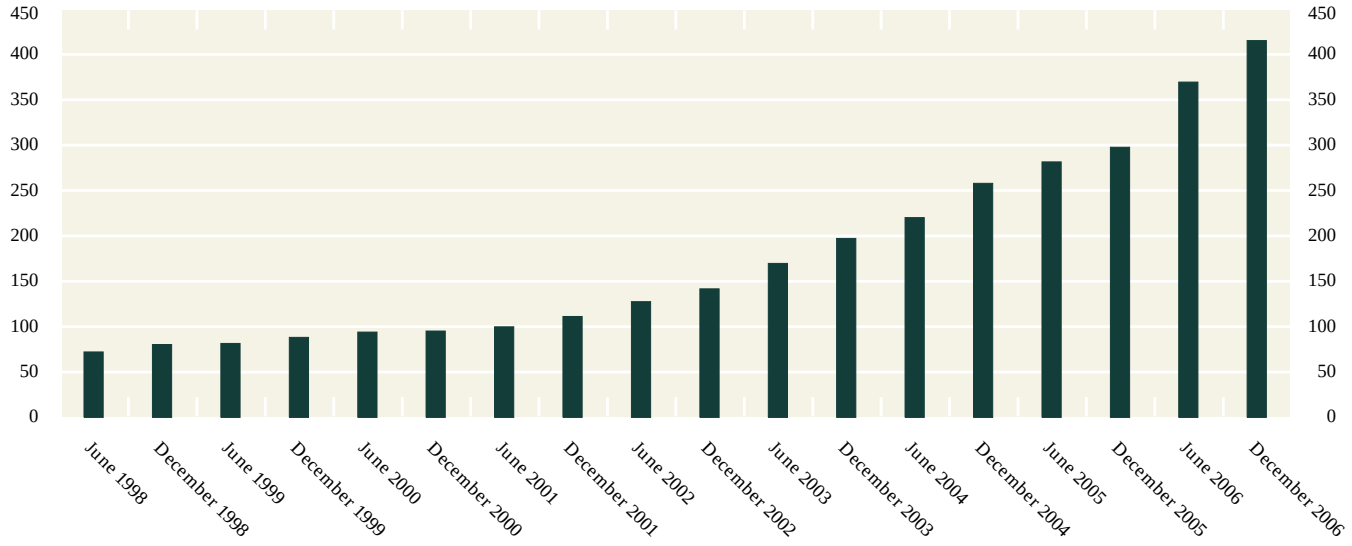
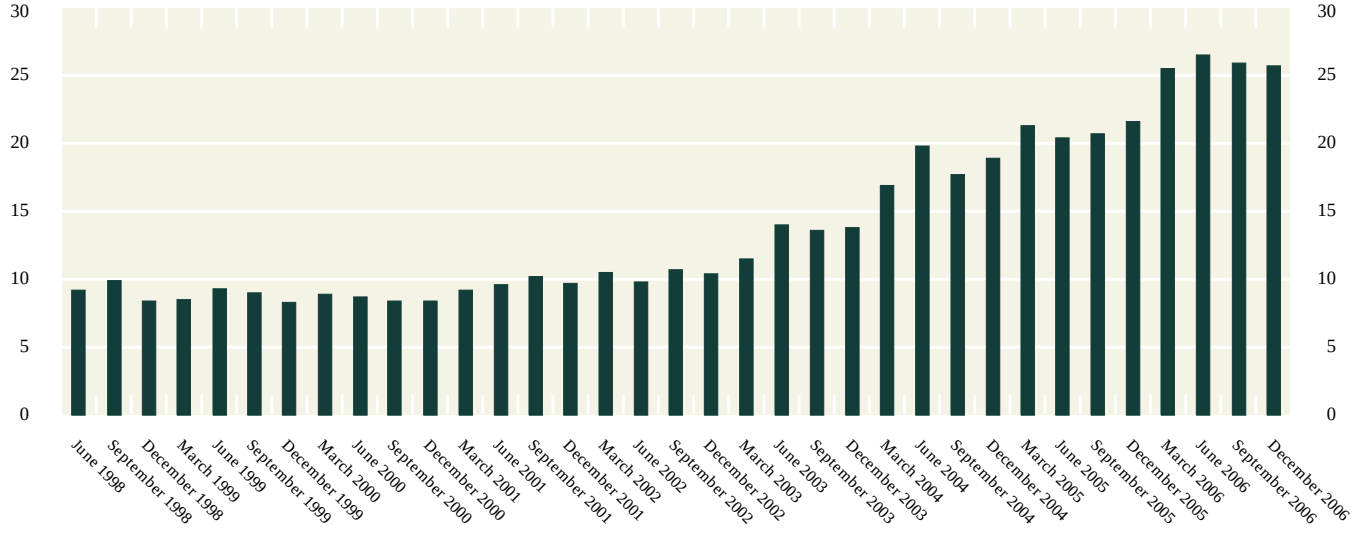


Chart 2

Volume of Exchange-Traded Derivatives

Notional amount, US$ trillions



Credit Derivatives: Growth and Challenges

Of all the segments of the derivatives market, credit derivatives received the most attention from workshop participants. The types of credit derivatives that have experienced the greatest growth are single- and multi-name credit default swaps (CDSs) and collateralized debt obligations (CDOs).[7] Growth in these instruments has been astounding. The notional amount of CDSs, for example, nearly doubled in each year for the past five years, with the amount outstanding growing from US$13 trillion in 2005 to nearly US$29 trillion in 2006. The amount of CDOs issued in 2006 was US$939 billion (BIS 2007), and the outstanding amount was estimated to be US$2.6 trillion.

Whether the benefits from the growth of derivatives markets and the associated innovations (described above) can be fully realized depends on how markets address the various financial-stability and risk-management issues posed by the use of these instruments. Three separate challenges related to credit and other derivatives were the focus of several discussions at the workshop.

The complexity of CDOs might also lead to the ultimate investors placing too great a reliance on the rating of the CDO tranches to guide their investment decisions.

The first challenge relates to the increasing complexity of these instruments, which, for many of the newer credit derivatives products, poses challenges to even the most sophisticated investors in terms of correctly modelling, understanding, and managing the embedded risk. It was noted that it is especially difficult to assess default correlations across several underlying reference assets in multi-name CDSs and in CDO tranches, making their valuation dependent on the underlying model's parameter assumptions about default correlations. Given this difficulty, concerns were raised about whether the ultimate holders of these instruments always fully grasp the nature of their risk exposures and how these exposures differ from those of more typical debt instruments, such as corporate bonds. The complexity of CDOs, as well as the requirement of many institutional investors to have their fixed-income holdings rated by a credit-rating agency, might also lead to the ultimate investors placing too great a reliance on the rating of the CDO tranches to guide their investment decisions.[8]

Secondly, there are concerns that secondary market liquidity for these instruments, particularly for CDOs, is less robust (or that these markets are more likely to become illiquid), owing to their complex model-driven valuation as well as to the lack of investor diversity and the concentration of intermediaries in these markets. Related to this, concerns were voiced that the cost of this potential market illiquidity was not fully reflected in the pricing of these instruments, leaving market participants exposed to sudden repricing and large mark-to-market losses in their portfolio holdings. This could trigger the simultaneous unwinding of crowded positions that would exacerbate the strains on market liquidity and could lead to detrimental knock-on effects on other debt markets and on financial intermediaries' balance sheets.[9]

Specifically, the advent of, and growth in, credit derivatives has essentially moved credit creation and the adjustment of credit exposures outside of the banking system. A sharp rise in asset-price volatility and concomitant drop in secondary market liquidity can now have a greater negative effect on credit creation than before. The greater connection between secondary market liquidity and the credit-creation mechanism is the necessary consequence of a system in which credit risk is "tradable" and dispersed outside the banking system, including among pension funds and leverage-investment vehicles such as hedge funds.[10]

7. CDSs basically provide insurance against the cost of default and various other credit events. That is, the protection buyer pays the protection seller periodic premiums in return for a payment if a credit event occurs. A CDO pools a portfolio of fixed-income assets into a tranched liability structure often seen in other securitized fixed-income instruments. The most common types of collateral for CDOs are asset-backed and corporate debt securities and syndicated loans. CDOs backed by loans are referred to as collateralized loan obligations (CLOs). Some do not in fact consider CDOs to be derivatives, but rather another type of fixed-income security. See Kiff and Morrow (2000), Kiff (2003), Reid (2005), and Armstrong and Kiff (2005) for more on credit derivatives in a Canadian context.

8. See International Monetary Fund (2006) for more on the possible over-reliance of institutional investors on credit-rating agencies.

9. For more on the market illiquidity issues, see Counterparty Risk Management Policy Group II (2005) and IMF (2006).

10. Since the workshop took place, these market-liquidity concerns related to credit derivatives have materialized as the events surrounding the global credit problems of August 2007 have unfolded. See Dodge (2007) and Longworth (2007) for details.

The issues posed by the infrastructure of OTC derivatives markets was the third challenge discussed at the workshop. The rapid growth of trading in credit and other OTC derivatives had (at the time of the workshop) largely outpaced the development of the infrastructure necessary to clear and settle those trades. Processing of completed trades was largely manual, and since trading volumes were increasing rapidly, derivatives dealers had accumulated a huge backlog of unconfirmed trades, even though they had greatly increased their back-office resources. Unconfirmed trades increase the potential for material mismeasurement and mismanagement of market and counterparty risk (see CRMPG II 2005; CPSS 2007). Steps to improve the situation were being undertaken jointly by regulators and the industry, but some workshop participants noted that, despite the substantial progress being made for uncomplicated derivatives, cleaning up the backlog for the more complex derivatives could still be challenging.

Inflation-Linked Derivatives

In recent years, the market for inflation-linked derivatives in Europe and the United States has grown rapidly. Futures contracts based on the U.S. consumer price index (CPI) and the euro zone harmonised index of consumer prices (HICP) (excluding tobacco) began trading on the Chicago Mercantile Exchange in 2004 and 2005, respectively. However, the largest segment of the inflation-linked derivatives market is the OTC inflation swap market that in essence began trading in 2001. An inflation swap is similar to standard interest rate swaps in which counterparties exchange cash flows based on a notional amount. For inflation swaps, counterparties exchange cash flows based on a fixed interest rate for variable payments linked to inflation.

Specifically, an inflation swap is a bilateral contractual agreement transacted in the OTC market. It requires one party to the contract (the inflation receiver) to make predetermined periodic fixed-rate payments in exchange for floating-rate payments linked to inflation from a second party (the inflation payer). Given that inflation swap contracts are traded OTC, a variety of contracts can be traded that incorporate different cash-flow structures to match the needs of the counterparties. The most popular type of contract, however, is the zero-coupon inflation swap, which has payments exchanged only on maturity.

In this contract, the fixed payments made by the inflation receiver for a *T*-year contract are calculated as follows:

$$fixed\ leg = (1 + fixed\ rate)^{T} \times notional\ value.$$

The variable inflation-leg payments made by the inflation payer are calculated as follows:

$$inflation\ leg = (inflation\ index_{at\ time\ T} / inflation\ index_{at\ inception}) \times notional\ value.$$

Although some swap contracts have extended further out, inflation swap maturities range, in general, from 1 year to 30 years.

The growth of this market resembles that of the IRS market in the early 1980s. It was noted during the workshop that the euro zone has the most liquid market, with an estimated total daily interdealer broker flow of roughly €500 million in the first part of 2006. In Europe and the United States, demand for inflation-linked swaps (i.e., demand to be the inflation receiver) stems from the demand by financial institutions and institutional investors to receive inflation-risk protection. In the United Kingdom and the United States, demand is mainly from pension funds, which seek to hedge long-term liabilities linked to inflation. In continental Europe, on the other hand, demand from financial institutions that sell inflation-protected instruments or inflation-linked deposits to retail or institutional investors is also significant.

The growth in inflation swaps activity has both coincided with, and been supported by, the significant increase in inflation-linked bond issuance in Europe and the United States (see Box). The same factors driving the demand for inflation swaps have also allowed for the greater issuance of inflation-linked bonds. However, inflation swap activity also relies on a sufficiently large and liquid inflation-linked bond market. That is, for dealers to make markets in inflation-linked OTC derivatives such as zero-coupon inflation swaps, they need to be able to economically hedge the inflation risk they take on as the inflation payer in one leg of the swap. Specifically, they must find an offsetting cash flow that is highly correlated with the cash flows that they are obliged to provide. Dealers have found that the most effective source of these offsetting cash flows is the purchase of government inflation-linked bonds denominated in the same currency (and based on the same inflation index) as the swap.[11] As such, large and liquid inflation-linked government bond markets with

11. If the dealer happened to be an inflation receiver in the contract, it would in this case hedge its position by selling inflation-linked bonds outright, if it owned them, or selling short, if it did not.

Box: Sovereign Inflation-Linked Bond Issuance

As of 2006, all G–7 countries* have inflation-linked bond issues, the value of which more than tripled between 2000 and 2006, reaching roughly US$1 trillion outstanding. The majority of the outstanding inflation-linked bonds are from the euro zone (largely France and Italy, which began issuing large volumes over this period), the United Kingdom, and the United States. These countries had an outstanding amount of US$260, $257, and $403 billion, respectively, at the end of 2006 (Hurd and Relleen 2006).

Although Canada has been issuing inflation-linked bonds (known as Real Return Bonds) since 1991, the volume (the outstanding amount of these bonds was $36 billion in 2006) has lagged substantially behind the volume of those issued in the euro zone, the United Kingdom, and the United States. Moreover, Canada has issued only four separate 30-year bonds over the years, while issuance in the three main inflation-linked bond jurisdictions has been across a variety of maturities, including 2-, 5-, 10-, 30-, and more recently, 50-year maturities.

* Sweden, Greece, and Australia also issue inflation-linked bonds.

a variety of outstanding bond maturities underpin the market-making activity of dealers in inflation swaps.[12]

Workshop participants noted that this likely explains the lack of inflation swap activity in Canada. It was pointed out that although Canadian institutional investors' demand for inflation-linked instruments had increased proportionate with the level of increase in the United Kingdom and the United States, the inflation-linked bond market does not have the required characteristics for dealers to effectively make markets in inflation swaps because of its insufficient size and liquidity.[13]

Another way dealers can hedge the inflation-payer obligations resulting from their inflation swap activity is to find investors who will engage in offsetting swap transactions rather than using inflation-linked bonds as a hedge. These investors or firms would tend to be those that have a "natural" source of inflation-linked cash flows. In the United Kingdom and elsewhere, corporations such as utilities, toll-road operators, or other infrastructure firms that have relatively stable inflation-linked revenues have increasingly become involved in the inflation swap market (McGrath and Windle 2006). These natural inflation payers have found participating in the inflation swap market an effective way to lower their cost of debt financing, given the robust demand from institutional investors for inflation protection. Workshop participants indicated that Canada could see a rise in inflation swap activity over time as natural Canadian inflation payers' awareness of the potential advantages of participating in the inflation-linked instruments increases.

Canada could see a rise in inflation swap activity over time as natural Canadian inflation payers' awareness of the potential advantages of participating in the inflation-linked instruments increases.

Concluding Remarks

Overall, the workshop discussions revealed how the recent rapid growth and development in derivatives markets are in many ways leading or reinforcing the

12. As an alternative to using inflation-linked bonds, dealers could, in principle, hedge their inflation risk exposure via recently introduced inflation futures contracts. But, given that inflation futures maturities don't extend much beyond one year, these are largely used to hedge only short-term inflation swaps.

13. Unlike the other G–7 countries, the Canadian government faces constraints on its ability to increase the size of any segment of its bond-issuance program because it has for several years experienced budgetary surpluses and in turn has been prudently reducing the amount of marketable debt outstanding.

trend towards the globalization of financial markets. The workshop also highlighted that derivatives instruments are intrinsically designed to transfer risk and to aid in price discovery, rather than to invest funds in an explicit claim on financial capital such as stocks and bonds. For this reason, the regulatory framework for derivatives exchanges (and their clearing and settlement organizations) can be quite different from that applied to equity and debt securities, as is the case in the United States. There, the statutory powers of the Commodity Futures Trading Commission (CFTC) acknowledge the implicit global nature of the futures exchange business. Moreover, the CFTC's regulatory framework is much more principles-based than, for example, the regulatory regime governing equity securities, since it reflects the main purpose of futures products, which is risk shifting and price discovery. It reflects as well the nature of the complex and continually evolving derivatives markets. A more principles-based regulatory approach is better suited for rapidly adapting to changing business structures, the introduction of new products, and market development.[14]

The development of the derivatives market was seen by workshop participants as providing broad economic benefits. By transferring and managing more risk in the capital markets, the banking system and the overall financial system might not only become more efficient, but also more resilient to shocks. Moreover, the development of derivatives markets will not only support economic and financial efficiency, but will also further contribute to improved financial stability.

The concerns raised about the use of derivatives are often related to their innovative features and complexity. As is the case whenever broad and rapid adoption of substantially new financial instruments occurs, there is the concern that market participants are not completely aware of, or do not fully understand, the explicit or implicit risks that arise in trading credit derivatives. History has shown that when this is the case, it often leads to an overextension of risk taking, a mispricing of financial instruments, and a hidden buildup of financial system vulnerabilities. Workshop discussion further highlighted how financial system distress is more likely to involve the evaporation of market liquidity in credit derivatives markets and to have far-reaching cross-border effects, given both the greater dependence of the credit-creation process on market liquidity (and in turn on an effective secondary market price-discovery process) and the globalization of finance. The events surrounding the August 2007 credit market strains would seem to bear out these concerns.

14. Note that the Autorité des marchés financiers in August 2007 published for comment a proposed framework for the regulation of derivatives markets in Québec that is based on core principles.

Literature Cited

Armstrong, J. and J. Kiff. 2005. "Understanding the Benefits and Risks of Synthetic Collateralized Debt Obligations." *Bank of Canada Financial System Review* (June): 53–61.

Autorité des marchés financiers. 2007. "Proposed Derivatives Framework." 10 August. Available at <http://www.lautorite.qc.ca/userfiles/File/projets-speciaux/produits-derives/Derives_consultation_ang_2007_08.pdf.

Bank for International Settlements (BIS). 2007. "Regular OTC Derivatives Market Statistics." May. Available at <http://www.bis.org/publ/otc_hy0705.htm>.

Committee on Payment and Settlement Systems (CPSS). 2007. "New Developments in Clearing and Settlement Arrangements for OTC Derivatives." Basel: Bank for International Settlements.

Counterparty Risk Management Policy Group II (CRMPG II). 2005. *Toward Greater Financial Stability: A Private Sector Perspective*. Report. 27 July. Available at <http://www.crmpolicygroup.org/index.html>.

Dodge, D. 2007. "Turbulence in Credit Markets: Causes, Effects, and Lessons To Be Learned." Speech to the Vancouver Board of Trade, Vancouver, British Columbia, 25 September.

Literature Cited (cont'd)

Hurd, M. and J. Relleen. 2006. "New Information from Inflation Swaps and Index-Linked Bonds." *Bank of England Quarterly Bulletin* 46 (1): 24–34.

International Monetary Fund (IMF). 2006. "The Influence of Credit Derivative and Structured Credit Markets on Financial Stability." In *Global Financial Stability Report*, 57–84. April. Available at < http://www.imf.org/External/Pubs/FT/GFSR/2006/01/pdf/chp2.pdf?>.

Kiff, J. 2003. "Recent Developments in Markets for Credit-Risk Transfer." *Bank of Canada Financial System Review* (June): 33–41.

Kiff, J. and R. Morrow. 2000. "Credit Derivatives." *Bank of Canada Review* (Autumn): 3–11.

Longworth, D. 2007. "Liquidity, Liquidity, Liquidity." Speech to the Investment Industry Association of Canada, Toronto, Ontario, 3 October.

McGrath, G. and R. Windle. 2006. "Recent Developments in Sterling Inflation-Linked Markets." *Bank of England Quarterly Bulletin* 46 (4): 386–96.

Reid, C. 2005. "Credit Default Swaps and the Canadian Context." *Bank of Canada Financial System Review* (June): 45–51.